

Pseudoaneurysm and Arteriovenous Fistula in the Radial Artery after Cardiac Catheterization: A Case Report

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Summary: We report the case of a 71-year-old man who was experiencing a gradually worsening, dull pain and a cold sensation in his right hand. Three months earlier, he underwent a percutaneous coronary intervention for angina pectoris using a transradial approach in his right wrist and developed an arteriovenous fistula (AVF), a complication of percutaneous coronary intervention. Ultrasonography and computed tomography revealed a pseudoaneurysm and an AVF that were reducing the blood flow in his right hand. We observed that the pseudoaneurysm and the AVF were close to the bifurcation of the superficial palmar artery (SPA) and that the superficial palmar arch had radial artery superiority. Because we thought it was important to maintain the blood flow of the SPA branch, we excised the pseudoaneurysm, sutured the artery directly via microsurgery, and ligated the arteriovenous shunt. After the operation, the patient's symptoms were alleviated. Computed tomography showed that the blood flow in his right hand was improved and that his right SPA branch from the radial artery was directly fed to the index finger. Because the blood circulation in the hand is dual dominant but with many anatomical variations, we believe that it is important to preserve the blood flow of the SPA in postcatheterization pseudoaneurysm and AVF repair. (*Plast Reconstr Surg Glob Open* 2022;10:e4022; doi: 10.1097/GOX.0000000000004022; Published online 12 January 2022.)

INTRODUCTION

The radial artery is commonly used for interventional procedures, such as percutaneous coronary intervention (PCI). Vascular complications such as pseudoaneurysms and arteriovenous fistulas (AVFs) are extremely rare with PCI using the radial artery approach. We report a case of pseudoaneurysm and arteriovenous fistula (AVF) caused by a transradial PCI, which was treated and improved by angioplasty using a method that preserved blood flow in the superficial palmar artery (SPA).

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Received for publication October 8, 2021; accepted November 9, 2021.

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DOI: 10.1097/GOX.0000000000004022

CASE REPORT

A 71-year-old man visited our outpatient clinic because he had a gradually worsening dull pain and a cold sensation in his right hand for 2 months. The skin color of his right hand was normal, but the right hand was slightly colder than his left hand. There were no tumors or scars on his right hand, and there were no abnormalities in his laboratory examinations to indicate a collagen disease. However, a thrill was palpable on the radial side of the right wrist, and the cutaneous veins around his right wrist were more dilated than those on the left.

He had a history of angina pectoris. Six months previously, he underwent PCI using the transradial approach in his right wrist for angina pectoris. Moreover, 3 months previously, a second transradial PCI was performed in his right wrist; one day later, an AVF was diagnosed by ultrasonography (US) (Fig. 1). The AVF was treated conservatively with a mechanical compression bandage for 1 day as soon as it was discovered, but it did not close. The angina pectoris improved, and there were no other abnormalities other than hypertension at discharge.

On presenting at our hospital with pain and coldness in the right hand, US and computed tomography (CT)

Disclosure: The authors have no financial interests to declare in relation to the content of this article. No funding was received for this study.

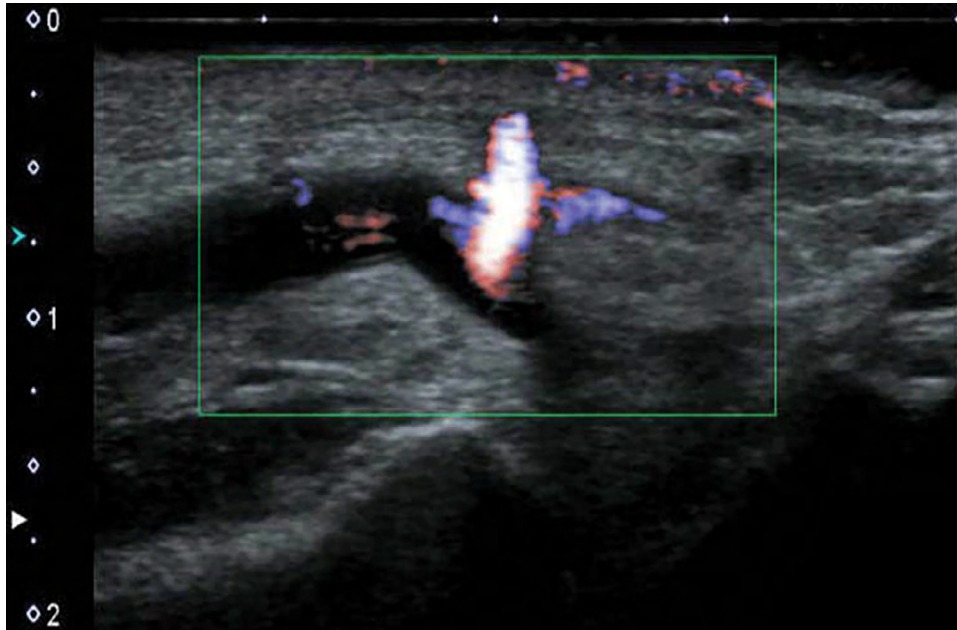


Fig. 1. Color Doppler ultrasonography showing a pseudoaneurysm of the radial artery.

were used to examine the right radial artery. US showed a pseudoaneurysm and an AVF. The arterial phase on the volume-rendered CT revealed a pseudoaneurysm of the radial artery. The radial artery and surrounding veins were simultaneously enhanced, whereas blood flow in the palmar and digital arteries was reduced (Fig. 2). This suggested that blood theft due to an AVF of the radial artery caused a decrease in blood flow in the palmar and digital arteries. Hence, we diagnosed a pseudoaneurysm and an AVF caused by the transradial PCI 3 months previously. The dull pain and cold sensation in his right hand were thought to be due to blood theft by the AVF, and the lesion was considered to be close to the bifurcation of the SPA.

We performed angioplasty of the right radial artery under general anesthesia. The sac of the pseudoaneurysm was relatively small, and a branch adjacent to it appeared to be an SPA branch (Fig. 3). To preserve the SPA branch, we resected the sac of the pseudoaneurysm and sutured the vessel directly during microsurgery. Then, we ligated the arteriovenous shunt.

Six months after surgery, the symptoms of dull pain, coldness, and palpable thrill were still alleviated. US showed no evidence of pseudoaneurysm or AVF. CT showed no venous enhancement around the radial artery, and the digital arteries were clearly highlighted without blood theft (Fig. 4). CT revealed that the SPA from the radial artery was not connected to the ulnar branch, and the circulation of the index finger was from the dominant SPA of the radial artery.

DISCUSSION

The radial artery approach is now commonly used for hemodynamic monitoring and cardiac interventional procedures because of its low vascular complication rate.^{1,2} The incidence of all vascular complications of the radial artery

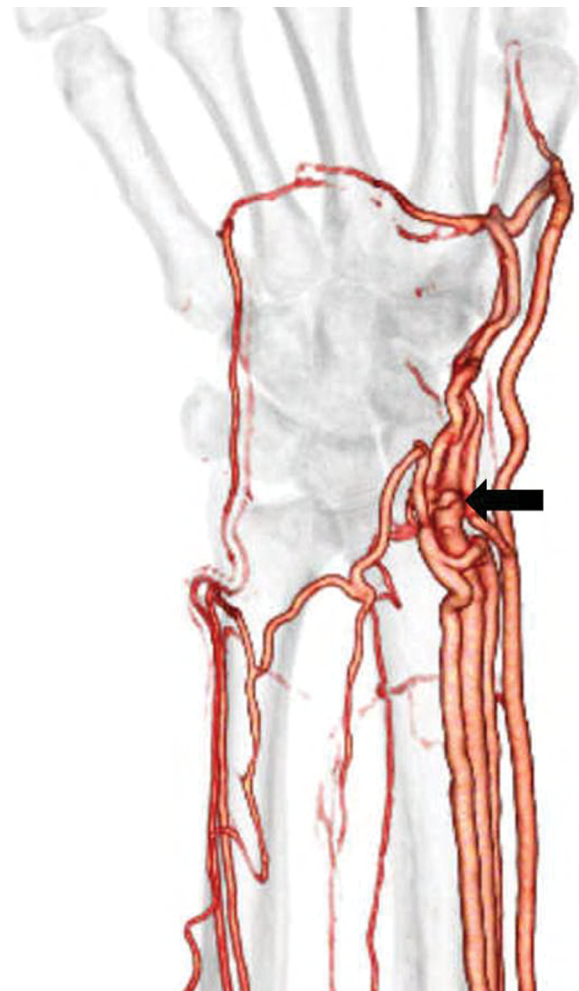


Fig. 2. The arterial phase on volume-rendered CT showing a pseudoaneurysm of the radial artery (arrow). Veins surrounding the radial artery are simultaneously enhanced. The blood flow of the SPA and the fingers are reduced.

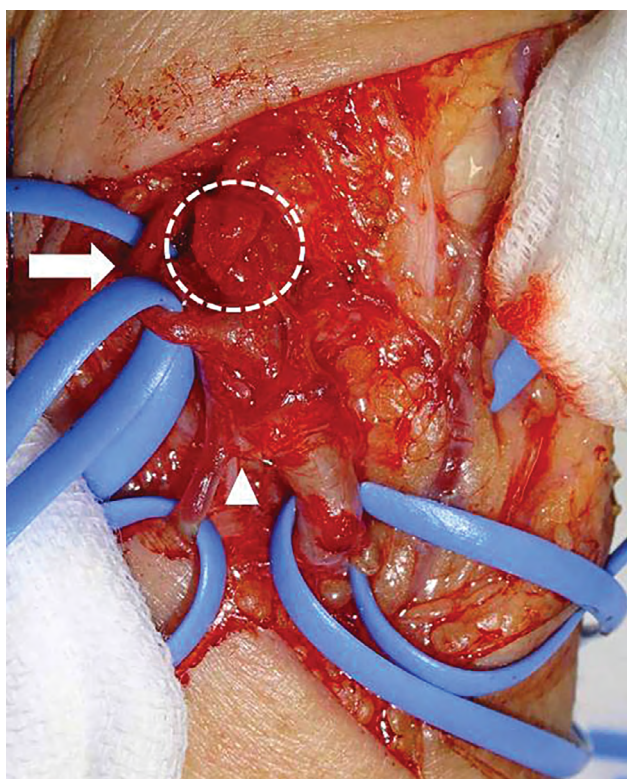


Fig. 3. An intraoperative image showing the pseudoaneurysm (dotted circle), arteriovenous fistula (arrowhead), and a branch of the SPA (arrow).

approach is rare at less than 1%, and the incidence of pseudoaneurysms and AVFs is lower still at less than 0.1% each.²⁻⁴

Hematomas are usually diagnosed immediately after or within a few hours of catheterization.^{2,4} However, half a day to several days later, pseudoaneurysms are found as pulsatile subcutaneous masses, and AVFs are noticed by a palpable thrill.^{2,4} When pseudoaneurysms and AVF are diagnosed by US, conservative treatment by mechanical compression bandaging is usually attempted immediately and is often successful in resolving the issues.²⁻⁴ In this case, an AVF was discovered the day after PCI and immediately treated with mechanical compression therapy for 1 day, but it was not successful.

Although there are no standard guidelines,⁵ invasive treatments are considered when conservative treatment fails. For endovascular treatments, percutaneous thrombin injections for pseudoaneurysms⁶ and biocompatible covered stents for AVFs have been reported,⁷ but they are not yet common. Surgery is recommended when the pseudoaneurysm is large or when conservative therapy is unsuccessful.⁸ Surgical methods range from simple radial artery ligation to vascular reconstruction with vein grafts. Even though blood circulation to the hand is dual dominant, there are various anatomical variations between the superficial and the deep palmar arches.⁹ Therefore, it is important to ensure adequate blood circulation to the fingers when considering surgical techniques. In this case, preoperative CT showed decreased blood flow in the superficial palmar arch due to the AVF in the radial artery.



Fig. 4. Postoperative CT showing that improved blood flow to the palm, fingers, and SPA from the radial artery is not connected to the ulnar side and directly feeds the index finger.

The pseudoaneurysm and the AVF were located close to the bifurcation of the SPA, and the SPA was considered to be radial artery dominant. Although the blood flow in the hand is dual dominant, in this case we thought it was necessary to replace the SPA branch with a bifurcated vein graft or to perform a bifurcation-sparing technique to maintain it. Because it did not require donor sacrifice and because the pseudoaneurysm was small, we preserved the blood flow to the fingers by resecting the pseudoaneurysm and suturing the artery directly using microsurgery. This technique is dependent on the size and location of the pseudoaneurysms of AVFs and may not always be possible. Therefore, it is important to be prepared to reconstruct the bifurcation.

Six months after the angioplasty, CT showed that blood flow in the right hand was still improved, but the superficial palmar arch was not connected. Instead, the SPA branch from the radial artery supplied the right index finger directly. This was considered to be congenital. We believe this case report highlights the importance of selecting a patient-specific surgical approach that preserves the blood flow of the fingers during an angioplasty of the radial artery in the wrist.

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